REMARKS/ARGUMENTS

Applicant has carefully reviewed the Office Action dated August 2, 2004 and the newly cited art. Reconsideration of the Examiner's rejection of the claims in their amended form is respectfully requested. A total of 27 claims remain in the case. Claims 1, 2, and 26 are currently amended and claims 3-25 and 49 remain as originally filed.

Amended claim 1 now contains the subject matter of claims 2 and 26. That is, amended claim 1 now recites "so that said foamed cellular particles can be used in conventional equipment to form said foam articles having a bulk density ranging between about 0.50 pounds per cubic foot (8.0 kilograms per cubic meter) and 6.0 pounds per cubic foot (96.1 kilograms per cubic meter) without impregnation of said foamed cellular particles with an additional amount of blowing agent prior to expanding and molding", and "a blowing agent range of 2.0 wt % and 5.0 wt %". The teaching that the foamed cellular particles can be used in conventional equipment finds support in the patent application and in some of the claims that have been withdrawn in view of the restriction requirement.

In amended claim 2, the lower weight percent of the blowing agent has been changed from 2.0 wt % to 2.5 wt % and the upper range of 5.0 wt% remains in the claim 2. Amendments to claim 26 include the deletion of the subject matter now appearing in amended claim 1.

Restriction Requirement

Applicant notes that the restriction requirement is deemed proper and is made final.

Claim Rejection Under 35 U.S.C. 102

Claims 1-26 and 49 are rejected under 35 U.S.C. 102 as being anticipated by WO 00/15703.

The Examiner's position is that the patentees disclose a foamed cellular article having the claimed apparent density and the claimed amount of blowing agent after being foamed with a greater amount of blowing agent initially in the foamable composition. It would have been inherent that the foamed particles would have had the claimed amount of blowing agent after sitting at room temperature after a predetermined time. The Examiner draws Applicant's attention to the abstract that calls for a content of 2% organic blowing agent, and on page 7 of the patent, 4% of the organic blowing agent can be employed in making the foam having the claimed apparent density. Pages 3 and 4 explain the purpose of the foamed polymer having such a high apparent density (so that it can be shipped to another destination and further foamed there to reduce the cost of shipping a higher volume foam).

The Invention

The invention pertains to foamed cellular particles that are formed from expandable, i.e. unexpanded, polymer particles that have a blowing agent, preferably, a volatile blowing agent, e.g. pentane, ranging preferably between 3.0 and 9.0 weight percent and a bulk density ranging from 640 to 514 kilograms per cubic meter. These expandable particles are then subjected to a first

expansion to form the foamed cellular particles of the invention with a bulk density between 550 kilograms per cubic meter and 200 kilograms per cubic meter. These foamed cellular particles as now claimed contain between 2.0 and 5.0 weight percent blowing agent. This amount of blowing agent is sufficient to render the foamed particles still "expandable" so that the density of the foamed particles can be brought down to one of commercial interest without having to impregnate the particles with an additional amount of blowing agent.

Examples 1, 2, and 4 of the patent application illustrate expandable particles having an initial density of 606, 609, and 591 kilograms/cubic meter, respectively, and a blowing agent amount of 4.24, 4.3, and 5.43 weight percent, respectively. These expandable particles are then expanded to a density of 422, 295, and 388-kilograms/cubic meter, respectively, to form the foamed particles of the invention. These foamed particles have a blowing agent amount of 3.86, 3.48, and 4.66 respectively, and when the foamed particles of Example 2 and 3 were subjected to a further expansion, the density of the particles was 14.1 and 15.2-kilograms/cubic meter, respectively. These latter densities were achieved in commercially available expansion equipment and did not require any reimpregnation of the foamed cellular particles with any additional blowing agent of any type. Also, these latter densities are in the range of commercially attractive foam end-use applications, e.g. foam cups, foam impact packaging, thermal insulation board, etc.

Since the foamed cellular particles of the invention contain enough blowing agent, they can very easily be

produced at the polymer's site and then transported to the converter's site where they are then expanded/molded via conventional equipment to produce articles of commercial interest.

The WO 00/15703 Publication

The particles of the cited publication are porous particles with an apparent density ranging between 600 and 200 kg/m^3 that contain 2.0% by weight or less, of a volatile organic blowing agent, e.g. pentane. On page 6 of the publication, it is taught that the amount of volatile organic blowing agent in the particles is 2.0% by weight or less, preferably, less than 1.5% by weight, and most preferably, the particles are free of an organic blowing agent. On page 7 of the publication it is taught that it is preferred to prepare the porous particles by using a process in which expandable particles containing a nucleating agent and from 0.5 to 4.0% by weight of a C_2-C_6 organic blowing agent are pre-expanded to a density of 600 to 200 kg/m^3, and more preferably, the porous particles are prepared by using a process in which expandable particles containing from 0.5 to 2.0% by weight of a volatile organic blowing agent, are pre-expanded to a density of 600 to 200 kg/m^3. Thus, not only is it preferred that the expandable particles from which the porous particles are formed contain less than 2.0% by weight, but the formed porous particles preferably, contain less than 2.0% by weight, of a volatile organic blowing agent.

Examples 1-5 of the publication show that the pentane content in the porous particles are respectively 1.77; 1.92; 1.77, 1.1, and 1.24, and the final density as

being 362; 427; 124; 125; and 316 kilograms/cubic meter, respectively. These densities are still in a relatively high range and in order to get down to densities of commercial interest, the particles need to be reimpregnated with a blowing agent. As taught in the publication, this then allows an inorganic blowing agent, such as nitrogen or oxygen gas, to be impregnated into the particles.

Similarity Between the Claimed Invention and the Cited Publication

A similarity between the invention and the cited publication is that the foamed particles of the invention and the porous particles of the cited publication are initially reduced to a density that may be three times lower than the original density of the expandable particles. However, as stated hereinabove, the weight percent of the organic blowing agent in the porous particles of the publication is 2% or less, preferably zero; whereas that of the foamed cellular particles of the invention ranges between 2.0 and 5.0 wt %. The density of the porous particles of the publication can be brought down to 362, 427, 124, 125, 316-kilograms/cubic meter as shown in Examples 1-5, respectively. However in order to be able to use these porous particles to form foam articles, an additional blowing agent needs to be impregnated into the particles, and as taught by this publication, this blowing agent is an inorganic blowing agent.

Differences Between the Claimed Invention and the Cited Publication

The foamed cellular particles of the invention have a blowing agent weight loss at least 15% to 50% lower than that of the expandable particles used to form the foamed cellular particles in the same time at room temperature. As explained in the specification, the reason for this is that since the foamed cellular particles are larger than the expandable particles, the mean path for diffusion of the blowing agent through the particle is longer, thereby increasing the shelf life of the foamed cellular particles. (Page 33, lines 26-31.) Also, since the foamed cellular particles will generally have a lower amount of blowing agent compared to the precursor expandable particles, the foamed cellular particles will have a lower driving force for diffusion.

The density range, the amount of blowing agent ranging between 2.0 and 5.0 weight percent, and the established cell structure of the foamed cellular particles of the claimed invention allow for a sufficient amount of blowing agent to remain in the cells for a sufficient period of time. The results are that the foamed particles of the invention can be transported to the converter's site; no additional blowing agent needs to be added to the foamed particles by the converter prior to molding the foamed particles into a foam article; and last but not least, the converter can use the particles in conventional pre-expanding/molding equipment to form the foam article.

In contrast to this, the porous particles of the cited publication contain less than 2 weight percent of an organic blowing agent, e.g. pentane, and additional blowing agents, preferably, inorganic blowing agents such as water, carbon dioxide, etc. need to be impregnated

into the particles for further expansion to produce articles with densities of commercial interest.

The process for forming foam articles of the invention is: Unexpanded, expandable particles are slightly expanded to form foamed particles. The foamed particles containing enough blowing agent, i.e. preferably 2.0 wt % to 5.0 weight percent pentane, can be shipped to the converter, i.e. end-user, e.g. the customer who produces the foamed article, and then molded into articles with low densities that may range between 14.1 to 28.8 kilograms per cubic meter (Examples 2, 4, 8, and 9), which are densities of commercial interest. No further impregnation of the particles is required prior to the molding step.

The process for forming foam articles of the publication is: Unexpanded, expandable particles are slightly expanded to form porous particles. The porous particles contain 2 wt % or less of a volatile blowing agent, e.g. pentane. These particles can be shipped to the converter's site. However, at the converter's site, these porous particles need to be impregnated with a blowing agent, preferably, an inorganic gas, e.g. carbon dioxide, nitrogen and/or oxygen-containing gases, or water, so that the particles can be further expanded, i.e. molded, to produce articles with densities of commercial interest.

A main objective of the cited publication involves using as little volatile organic blowing agent as possible whereby a very small amount is initially impregnated into the expandable particles and a very small amount remains in the porous particles, whereby an

inorganic blowing agent can then be used to further impregnate the particles for molding into foam articles.

A main objective of the present invention is to use a substantial amount of blowing agent, preferably, a volatile organic blowing agent, e.g. pentane to produce the expandable particles which remains in the foamed particles that are ultimately used for molding the foamed particles into foamed articles.

Comparative Experiment in WO 00/15703

This Comparative Experiment illustrates expandable particles containing 6.2% by weight pentane that are pre-expanded to a bulk density d_o of 520 kg/m^3. These pre-expanded particles contain 5.9% by weight pentane, and after being placed in a batch steam expander, expand to a bulk density d of 14.9kg/ m^3. The calculated ratio d_o/d was 34.9. This Comparative Experiment was used to show that high density expandable particles were not the same type of particles as that of Examples 1-5 which are essentially free of any volatile organic blowing agents in that the expansion ratio of this Comparative Experiment is relatively high, i.e. 34.9 compared to 1.4, 1.3, 2.1, 2.8, and 1.4, respectively, of Examples 1-5. These values for the ratio d_o/d of Examples 1-5 show that the porous particles do not essentially expand any further or only slightly whereas the very high-density expandable particles of the Comparative Experiment are still expanding. These very high-density expandable particles of the Comparative Experiment are standard expandable polystyrene (EPS) particles. They are not initially slightly expanded to retain the blowing agent

in the particles for a sufficient time as those of the invention.

Summary and Conclusion

The claimed invention, particularly that of amended claim 1, is not taught, disclosed, or even suggested in the cited publication. Independent claim 1 is not anticipated or obvious in view of the teachings of the cited publication. Dependent claims 2-26 and 49 are patentable on their own merits in addition to being directly or indirectly dependent on a patentable claim 1.

Applicant for the first time discloses and claims foamed cellular particles formed from expandable particles having a blowing agent, preferably, pentane in an amount ranging between 2.0 and 5.0 wt % based on the weight of the polymer, which are initially slightly expanded and for a predetermined time at room temperature has a blowing agent weight loss at least 15% to 50% lower compared to the expandable particles in the same predetermined time at room temperature so that said foamed cellular particles can be transported to an end-user and used in the end-user's conventional equipment, i.e. pre-expander/molder, to form foamed articles with a bulk density ranging between about 0.50 pounds per cubic foot (8.0 kilograms per cubic meter) and 6.0 pounds per cubic foot (96.1 kilograms per cubic meter) without the need to re-impregnate the foamed cellular particles with an additional amount of blowing agent prior to expansion/molding.

The only similarity between the claimed invention and the publication is that in a first step the unexpanded particles are slightly expanded. However, as discussed herein above, the claimed invention involves more than a

slight density reduction in a first expansion step. The blowing agent, which preferably is a volatile organic, i.e. pentane, is retained in the foamed cellular particles of the invention for the molding process, whereas very little or no volatile organic blowing agent is in the porous particles of the publication so that an inorganic blowing agent can be impregnated into the particles for the molding process.

The amendments to the claims do not result in any additional fees. If a fee, however, is due, than Applicant authorizes his Account No. 506179 to be debited accordingly.

Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Respectfully submitted,

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